Summary of the Commercial Harvest of Lake Whitefish for Quota Years 1998-1999 and 1999-2000 in the Wisconsin Waters of Lake Michigan and the Status of the North/Moonlight Bay Stock of Lake Whitefish

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ABSTRACT

The reported commercial harvest of lake whitefish *Coregonus clupeaformis* from the Wisconsin waters of Lake Michigan during quota year 1998-99 was a record setting 1,800,316 pounds with 4.8 percent of the total harvest from pound nets, 51.1 percent in trap nets, and 44.1 percent in gill nets. Whitefish harvest dropped two percent in quota year 1999-00 to 1,768,436 pounds. During the 1999-00 quota year, 4.9 percent of the total harvest occurred in pound nets, trap net harvest increased to 69.1 percent, and gill net harvest decreased to 26 percent. The total annual quota of whitefish for Wisconsin commercial fisherman has been increased four times since it was first established at 1.15 million pounds in quota year 1989-90 and is currently at 2.47 million pounds.

Whitefish mean length and weight at age (ages 2-5) in spring 1999 were the lowest documented since 1985 and the condition of whitefish, ages two through five, has decreased. As a result of the decreased length and weight at age, the age at which whitefish are fully recruited to the commercial fishery has increased from age four to age five.

The spring graded mesh gill net (GMGN) juvenile whitefish survey conducted over the past two years has been a near bust. Overall CPE of whitefish in the spring survey dropped from 59.4 whitefish per 1,000 feet of net in the spring of 1998 to a CPE of 12.0 in the spring of 1999, and a CPE of 4.6 in the spring of 2000. This survey typically provides the first indication of whitefish year class strength, two or more years before they show up in the commercial fishery. Recently, the 1991, 1993, 1994, 1995, and 1997 cohorts seem to be particularly strong, and the 1992 and 1996 cohorts seem to be weaker than most. Not enough information is available to evaluate the 1998 year class.

Based on the fall GMGN survey there has been a continued progression of moderate to strong year classes of the NMB stock of whitefish recruiting to the commercial fishery. In addition to no missing year classes in the NMB whitefish population currently vulnerable to the fall GMGN survey, there continues to be good survival to age seven and older. Observations from the fall GMGN survey support those from the spring juvenile survey in that the 1992 year class that showed up as weaker than most in the juvenile surveys is also weaker than most in the fall surveys. The 1996 year class first captured at age three in the fall of 1999 (although not fully vulnerable to the gear) was captured at a lower rate than all other cohorts.

The kill of incidental fish in the Wisconsin commercial whitefish fishery has gone up slightly over the last six years, but this is primarily a result of increased levels of commercial effort and not an increase in the rate of kill of incidental species. The three most common salmonids species killed during commercial whitefish operations are lake trout *Salvelinus namaycush*, chinook salmon *Oncorhynchus tshawytscha*, and brown trout S*almo trutta*. Gill netting is responsible for a much larger share of the incidental kill than either trap nets or pound nets. During the last two license years gill nets have accounted for approximately 35 percent of the whitefish harvest but 96 percent of the incidental kill of lake trout and 94 percent of the incidental kill of chinook salmon. Trap nets on the other hand have accounted for nearly 60 percent of the whitefish harvest during the same time period and have accounted for 3 percent of the incidental kill of lake trout and 6 percent of the chinook salmon.

Total annual mortality (A), based on pooled samples of whitefish collected during fall GMGN assessment (1997-1999) was 57.2 percent for ages 5-12. Mortality has increased slightly over the past decade for these commercially vulnerable ages as a group. Annual mortality for the youngest segment of the exploitable population, ages 5-8, was 53.7 percent. For this group, which contributed most to the commercial harvest, mortality has decreased slightly over the last decade.

INTRODUCTION

Lake whitefish *Coregonus clupeaformis* (whitefish) continues to rank economically as one of the most important species in Wisconsin's Great Lakes commercial fishery. Most of the whitefish harvested from Lake Michigan by Wisconsin commercial fisherman belong to the North/Moonlight Bay (NMB) stock, whose major spawning grounds are concentrated along the eastern shore of Door County. Since July 1989 the commercial harvest of whitefish in Wisconsin waters has been under enforced quota control. This stock is also heavily exploited by state of Michigan commercial fisherman in the waters of Green Bay (Ebener 1980), but their harvest is not currently under enforced quota control.

In order to maintain current data on this whitefish stock and quota fishery in Wisconsin waters of Lake Michigan including Green Bay, catch statistics were summarized and lifts of commercial fishing gear were sampled by Wisconsin Department of Natural Resources (WDNR) personnel during quota years 1998-1999 and 1999-2000 (July 1998-June 2000). The WDNR also conducted whitefish sampling from the research vessel Barney Devine (RVBD) with graded mesh gill nets (GMGN) in the spring for juvenile whitefish and in the fall near the spawning grounds for mature whitefish.

Similar data has been collected and reported annually by WDNR since the late 1970's (Lychwick and Moore 1979; Toneys 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1990, 1992, 1993, 1994; Peeters 1996, 1998). Data collected by Michigan Department of Natural Resources (MDNR) in state of Michigan waters is used when available (Schneeberger 1994 and 1996).

METHODS

The whitefish population in Wisconsin waters of Lake Michigan and the Wisconsin commercial fishery that harvests that population are evaluated by a number of different techniques. The harvest of the commercial fishery is tracked through catch reports, lifts of commercial gear are monitored, and the WDNR conducts targeted whitefish surveys with the RVBD.

Wisconsin commercial fishermen are required to submit biweekly commercial catch reports. These reports are reviewed and entered into a computer data base biweekly. Commercial fishery catch statistics are summarized from this database. Whitefish harvest is analyzed by gear type, by commercial management zone, and by statistical district. Currently, the commercial fishery information is analyzed and reported by quota year which runs from July 1st through the following June 30th. Prior to 1989 commercial fishery statistics were analyzed and reported by calendar year. In Wisconsin the commercial harvest of whitefish is reported in pounds of dressed fish (viscera removed). MDNR reports the Michigan commercial harvest of whitefish in round weight (viscera not removed). In this report where the weight of whitefish harvested in the state of Michigan is discussed, the weight has been converted to dressed weight (round weight/1.17 = dressed weight). All weights in this report which describe the commercial harvest of whitefish are dressed weight unless otherwise specified.

Lifts of commercial gear including pound, gill, and trap nets were monitored in Statistical Districts WM1 (Zone 1), WM2 and WM3 (Zone 2), and WM4 and WM5 (Zone 3) (Figure 1) from July 1998 through June 2000, primarily during spring and fall. All, or a portion of, whitefish from each monitored lift were measured (total length, in mm) and some were weighed (round weight, in grams). Scales were collected from a subsample of fish for determination of age.

GMGN (3½-5½ inch, stretch measure) were fished from the RVBD during mid November in 1998 and 1999 (whitefish spawning season), on Cardys Reef (grid 706) to assess the relative abundance and age composition of the mature, whitefish near the spawning grounds. All whitefish were processed as described above.

GMGN (2-3½ inch, stretch measure) were fished from the RVBD during mid to late May 1999 and 2000 on Cardys Reef (grid 706) to assess relative abundance of prerecruit whitefish. All whitefish were processed as described above.

Whitefish were aged using the scale aging technique as described by Lagler (1952). Whitefish scales were collected in spring (April and May) and again in fall (October and November) by removing a small number of scales (5-15) from an area below the anterior insertion of the dorsal fin and above the lateral line. Scales were collected from up to 20 whitefish from each 10 mm grouping. Scales were read using a microfiche reader with approximately 50X magnification.

Whitefish aged by the scale aging technique were used to develop a length at age key for spring and fall for each year covered by this report. Length frequencies of whitefish from the various commercial gear type monitors and GMGN surveys were aged using the appropriate spring or fall length at age key.

Condition (K) was calculated using a Fulton-type method as described in Anderson and Gutreuter (1983), where K = weight (g) x 100,000/ length (mm) ^{3}. To avoid possible variations caused by gonad development or condition, only whitefish sampled in spring were utilized for this analysis. Calculations were based on the mean weights and mean lengths of aged (by scale analysis described earlier) whitefish caught during the spring GMGN survey conducted on Lake Michigan near Baileys Harbor and sampled during spring commercial monitors.

Total annual mortality (A) was calculated using the least squares regression method (LSRM) (Ricker 1975). Calculations were based on pooling fall spawning assessment data for a period of three consecutive years, 1997-1999.

Estimates of salmonids killed incidental to the whitefish fishery were calculated by multiplying the mean kill rate of each species, observed during onboard monitored commercial lifts, during the period January 1998 through December 2000, by the total annual effort for each gear in each of Wisconsin's statistical management areas. In addition to the incidental kill observed by onboard monitors during trap netting operations, the incidental kill associated with trap net leads has been incorporated into the kill rate for trap nets. This additional kill rate was developed from information collected during extensive trap net diving (SCUBA) in WM3 during the summer of 1999. The kill rate in trap net leads was determined by diving on individual trap nets, swimming the entire lead of the trap net and marking all dead fish in the lead, then after a known length of time repeating the procedure. This procedure documented new (unmarked) dead fish in the lead, over a known length of time and allowed the establishment of a rate of kill in trap net leads, which was then added to the incidental kill rate established during onboard trap net monitors. Incidental kill estimates, for each species observed dead in the gear, are listed by year, by area, by gear.

RESULTS AND DISCUSSION

QUOTA, HARVEST, EFFORT, AND CATCH RATES, July 1998 through June 2000

The total annual quota of whitefish for Wisconsin commercial fisherman has been increased four times since it was first established at 1.15 million pounds in quota year 1989-90. It was increased to 1.3 million pounds in quota year 1991-92, up to 1.45 million pounds for quota year 1995-96 up to 1.77 million pounds for quota years 1996-97, and up to 2.47 million pounds for quota year 1998-99 (Table 1; Figure 2).

The reported commercial harvest of whitefish from the Wisconsin waters of Lake Michigan during quota year 1998-99 was a record setting 1,800,316 pounds. Harvest was up in all three commercial zones. However, because the allocated quota had been increased by 40 percent for quota year 1998-99, the percent of quota harvested, actually dropped in all three zones (Table 1; Table 2; Figure 2). During the 1998-99 quota year, 4.8 percent of the total harvest occurred in pound net, 51.1 percent in trap net, and 44.1 percent in gill net (Table 2; Figure 2). This was the first quota year since 1992-93 that more whitefish were caught with trap nets than gill net. The increased trap net harvest was the result of a 9.6 percent increase in trap net effort combined with a 20.9 percent increase in catch per effort (CPE). Gill net effort also increased (46 percent) but CPE in gill net was down 29.1 percent (Figures 3 and 4).

Whitefish harvest dropped two percent in quota year 1999-00 to 1,768,436 pounds (whitefish harvest was up slightly in zones two and three but down 59.7 percent in zone one). During the 1999-00 quota year, 4.9 percent of the total harvest occurred in pound net, trap net harvest increased to 69.1 percent, and gill net harvest decreased to 26 percent (Table 2; Figure 2). The dramatic increase in trap net harvest was the result of trap net effort increasing by 61.8 percent (even though there was a 18.6 percent decrease in CPE) while gill net effort decreased by 20.7 percent (concurrent with gill net CPE decreasing by 26.6 percent) (Figures 3 and 4). Two additional commercial licensees began fishing trap net gear in lieu of gill nets in license year 1999-00.

All current published studies provide evidence that most of the whitefish harvested in Michigan waters of WFM 00 (Figure 1) probably belong to the NMB stock of whitefish (Hogman 1971; Ebner 1980; Hastreiter 1981; and Rowe 1984). The harvest of whitefish from Michigan's WFM 00 is reported by calendar year. From 1984 through 1991 the Michigan harvest of whitefish in WFM 00 averaged approximately 600,000 pounds (Figure 5). When Wisconsin implemented a whitefish quota in 1989, a 650,000 pound portion of the total calculated whitefish quota for the NMB stock was set aside to account for harvest of the NMB stock in Michigan waters (WFM 00), based on historical harvest there. Through 1991, Michigan harvest remained below that level. From 1992 through 1994 the whitefish harvest in Michigan Zone WFM 00 increased to approximately one million pounds annually and the poundage of whitefish set aside by Wisconsin to account for the harvest in WFM 00 was increased to 900,000 pounds in 1995. Whitefish harvest continued to increase in WFM 00 and by 1996 had reached approximately 1.4 million pounds. With the quota review in 1996, Wisconsin set aside 1.23 million pounds to account for Michigan harvest in WFM 00. During calendar years 1995 through 1997 whitefish harvest in Michigan WFM 00 averaged almost 1.5 million pounds (Table 3). This harvest was split between trap nets and trawls, with trap nets accounting for just over 50 percent of the harvest. In 1998 when the quota was last adjusted, the set aside was increased to 1.46 million pounds to account for the Michigan whitefish harvest. From 1997 through 1999 the Michigan harvest dropped from nearly 1.5 million pounds to just over 0.7 million pounds and has averaged just over 1.1 million pounds (Table 3).

SIZE AT AGE

Mean length and mean weight at age have fluctuated widely over the last 17-year period. However, during the four year period from 1996 through 1999 there was a distinct downward trend in length and weight at age (Figure 6; Table 4). Whitefish length and weight at age (ages 2-5) in the spring 1999 were the lowest documented since 1985. There was enough of a change in that four-year period that it increased the age at which whitefish are recruited to the commercial fishery. Whitefish from the NMB stock are not currently fully recruited to the commercial fishery until age five.

Another way to analyze the apparent decrease in mean length and weight at age is to follow individual cohorts as they age. Figure 7, (Table 4) illustrates the size at age of five recent cohorts from the NMB stock. When the 1988 year class of whitefish from the NMB stock reached four years of age in the spring of 1992, it had a mean length of 462 mm and a mean weight of 0.96 kg. At this size the 1988 year class was at least partially recruited to the commercial fishery and vulnerable to the gear being used. When the 1996 year class reached age

four in the spring of 2000 it averaged 366 mm and 0.41 kg. The minimum legal size for the commercial whitefish fishery is 432 mm. Only the fastest growing individuals from this cohort would have attained the minimum legal size.

Concurrent with the decline of mean length and weight at age, there has marked decline in the condition of whitefish in the NMB population (Figure 8, Table 4). Condition (K) as used in this context is a measure of the relative plumpness of the fish. From 1995 through 1999, ages two through six exhibited a distinct downward trend in condition. Schneeberger (2000) has demonstrated a similar trend in whitefish (through 1998) from the Michigan waters of Lake Michigan. In the spring of 2000, ages two and three demonstrated a reversal of this trend.

Growth, as measured by change in mean length and weight at succeeding ages and the condition of individuals in a fish stock, could be affected by a number of factors. Possible explanations include: a changing food supply which whitefish might not have adapted to; a declining food supply because of changes in the food web; increased competition for the food supply available, from other species or more numerous whitefish; or a change in an environmental condition, i.e. water temperature, which could environmentally isolate whitefish from their food supply. Determining the cause of the recent noted decline in mean length and weight at size and a decline in condition is beyond the scope of this report.

AGE COMPOSITION IN THE HARVEST

Over the last seven years, the age of whitefish harvested in the fall trap net fishery in Zone Two has changed markedly. In the fall of 1993 and 1994 the harvest was dominated by age four whitefish at 54.4 and 57.1 percent respectively. Age three fish averaged 9.1 percent, age five fish averaged 23.5 percent, and age six fish averaged 5.5 percent of the harvest (Figure 9). Over the last two years (1998 and 1999) the percent of age three whitefish fish in the Zone Two, fall trap net fishery dropped to 1.1 percent. Age four whitefish averaged 31.8 percent, age five fish averaged 37.2 and age six fish averaged 20.9 percent. This trend of older fish in the harvest is likely the result of decreased size at age and delayed recruitment to the commercial fishery. Another possible explanation of any change in the age of whitefish in a particular year of the fishery could be year class strength. However, that is an unlikely explanation in this case, considering the declining trend of mean length and weight at age, that has continued for five years now.

The same trend of increasing age of whitefish in the fall trap net fishery also shows up in the spring trap net fishery in Zones Two and Three (Figures 10 and 11). In 1995, age four whitefish made up 59.7 percent of the Zone Two, and 50 percent of the Zone Three spring trap net harvest. In the last two years, age four whitefish harvested in the spring trap net fishery, averaged 13.6 percent Zone Two and only 10.6 percent in Zone Three. During the same time period, age six whitefish in the spring trap net harvest went from 5.6 percent in Zone Two and 10.6 percent in Zone Three to an average of 22.7 percent in Zone Two and 24.5 percent in Zone Three. As discussed above in the fall harvest analysis, the increased age of whitefish in the harvest is probably a result of delayed recruitment of whitefish to the commercial fishery as a result of decreased growth rates in the NMB whitefish stock. Age of whitefish in the harvest, in spring, in Zones Two and Three is remarkably similar, reinforcing the contention that whitefish harvested in both Zones belong to the same stock of whitefish (NMB).

SPRING GMGN JUVENILE WHITEFISH SURVEY

The spring GMGN juvenile whitefish survey conducted over the past two years has been a near bust. Overall CPE of whitefish in the spring survey dropped from 59.4 whitefish per 1,000 feet of net in the spring of 1998 to a CPE of 12.0 in the spring of 1999, and a CPE of 4.6 in the spring of 2000. The GMGN juvenile survey is conducted from the RV/Barney Devine near Baileys Harbor specifically for juvenile whitefish. The spring GMGN survey specifically targets juvenile whitefish by fishing panels of relatively small mesh gill netting (2, 2½, 3, and 3½ inch stretch mesh). This survey typically provides the first indication of whitefish year class strength, two or more years before they show up in the commercial fishery.

Whitefish are a schooling fish and their distribution is uneven and patchy. The efficiency of the spring GMGN juvenile survey for catching the pre recruit whitefish has been quite variable. Because of the variable efficiency, results between different survey years are not directly comparable but are rather a relative index. However, the different CPEs of the various year classes within a year's survey should be comparable. In recent years the spring GMGN survey has documented a consistent production of moderate to strong year classes from the NMB stock of whitefish (Figure 12, Table 5). Recently, the 1991, 1993, 1994, 1995, and 1997 cohorts seem to be particularly strong, and the 1992 and 1996 cohorts seem to be weaker than most. Not enough information is available to evaluate the 1998 year class.

FALL GMGN SPAWNING WHITEFISH SURVEY

Based on the fall GMGN survey there has been a continued progression of moderate to strong year classes of the NMB stock of whitefish recruiting to the commercial fishery (Figure 13, Table 6). In addition to no missing year classes in the NMB whitefish population currently vulnerable to the fall GMGN survey, there continues to be good survival to age seven and older. Whitefish first show up in the fall GMGN survey as age three, but are not fully vulnerable to the gear until age four. Whitefish year class strength is probably well established long before age four. Once a year class is fully vulnerable to the survey gear, you would expect decreasing CPE's as the cohort ages and moves through the fishery due to mortality.

Similar to the spring juvenile surveys, comparisons of the fall spawning surveys between years are not directly analogous (because of yearly variance), but observations between cohorts within a year's survey should be. Observations from the fall GMGN survey support those from the spring juvenile survey in that the 1992 year class that showed up as weaker than most in the juvenile surveys is also weaker than most in the fall surveys. In the fall of 1996 the 1991 year class at age five was captured at double the rate of the 1992 year class at age four. The following year (1997), the 1991 year class now age six was still captured at a higher rate than the 1992 year class at age five. The 1996 year class first captured at age three in the fall of 1999 (although not fully vulnerable to the gear) was captured at a lower rate than all other cohorts, that year, through age eight.

MORTALITY

Total annual mortality (A), based on pooled samples of whitefish collected during fall GMGN assessment (1997-1999) was 57.2 percent for ages 5-12 (Table 7). Mortality has increased slightly over the past decade for these commercially vulnerable ages as a group.

Annual mortality for the youngest segment of the exploitable population, ages 5-8, was 53.7 percent. For this group, which contributed most to the commercial harvest, mortality has decreased slightly over the last decade.

INCIDENTAL KILL OF THE WISCONSIN COMMERCIAL WHITEFISH FISHERY

The kill of incidental fish in the Wisconsin commercial whitefish fishery has gone up slightly over the last six years (with a slight decrease in gill net in 1999-00) (Figures 14 and 15), but this is primarily a result of increased levels of commercial effort and not an increase in the rate of kill of incidental species. Some level of incidental catch and kill of non-targeted fish is to be expected in commercial fishing gear.

During the period January 1998 through December 2000 a substantial amount of commercial whitefish lifts were monitored. This included 27 onboard gill net monitors during which 188,600 feet of gill net was lifted, 66 onboard trap net monitors that observed 247 pots lifted, and four onboard pound net monitors that observed five pound nets lifted. Additionally, during the summer of 1999 an extensive amount of trap net diving was conducted in WM3. From July through September, 22 separate trap net lead dives were completed. Prior to the summer of 1999, the incidental kill associated with trap net leads was undocumented. The incidental kill rate in trap net leads developed through repetitive dives on individual net leads allowed for a more complete understanding of the overall incidental impact of trap nets than established during onboard monitors alone. The incidental kill rate developed for trap net leads in WM3 was also used to estimate the incidental kill associated with trap net leads in all other statistical districts as no other estimates are available.

The three most common salmonids species killed during commercial whitefish operations are lake trout *Salvelinus namaycush*, chinook salmon *Oncorhynchus tshawytscha*, and brown trout S*almo trutta* (Table 8). Currently, the level of incidental kill is substantially less than it has been historically. As recently as 1987, when approximately 24 million feet of large mesh gill net was fished in Wisconsin, it was estimated that over 45 thousand lake trout and nearly 11 thousand chinook salmon were killed incidental to the whitefish fishery. Figure 14 gives a historical perspective of how the gill net effort and the incidental kill of lake trout and chinook salmon have varied over the last 15 years. Figure 15 depicts trap net effort and associated incidental kill of lake trout and chinook salmon (in the pots and the leads) over the same time period. Gill netting is responsible for a much larger share of the incidental kill than either trap nets or pound nets. During the last two license years gill nets have accounted for approximately 35 percent of the whitefish harvest but 96 percent of the incidental kill of lake trout and 94 percent of the incidental kill of chinook salmon. Trap nets on the other hand have accounted for nearly 60 percent of the whitefish harvest during the same time period and have accounted for 3 percent of the incidental kill of lake trout and 6 percent of the chinook salmon.

In addition to the incidental mortality of lake trout, chinook salmon, and brown trout, there is also mortality of other fish species associated with the Wisconsin commercial whitefish fishery. Other fish observed to be killed incidental to the harvesting of whitefish during the past three years included: burbot *Lota lota,* white sucker *Catostomus commersoni,* long nose sucker *Catostomus catostomus*, yellow perch *Perca flavescens,* walleye *Stizostedion vitreum*, menominee *Prosopium cylindraceum,* rainbow smelt, *Osmerus mordax,* gizzard shad *Dorosoma cepedianum,* alewife *Alosa pseudoharengus,* and northern pike *Esox lucius.*

STATUS OF THE NMB WHITEFISH STOCK AND MANAGEMENT IMPLICATIONS

In summary, the NMB stock of whitefish is in good condition and has apparently increased in abundance over the last decade due to continued moderate to strong year class recruitment, moderate mortality, and controlled harvest. The whitefish quota has been increased four times since it was first established in license year 1989-90. At present the whitefish quota for the Wisconsin waters of Lake Michigan including Green Bay is set at 2.47 million pounds. Although the commercial industry has not caught the full increased quota during the past two years, Wisconsin commercial fishermen are harvesting whitefish at the highest levels in history.

The 1992 year class, identified in both the spring and fall GMGN surveys as weaker than most, has just about worked its way through the commercial fishery. The 1996 year class, identified as weaker than most and just about to enter the commercial fishery, was preceded by three strong year classes. An occasional weak year class has not dramatically affected the Wisconsin commercial whitefish fishery. The NMB whitefish stock demonstrates good survival through age seven and the commercial fishery does not depend on a single year class. Mean length and mean weight at age, for the NMB stock, has decreased to the point where cohorts take an additional year to recruit to the commercial fishery. The reasons for the decreased length and weight at age are unknown at this time and are beyond the scope of this study.

The incidental kill of salmonids associated with the Wisconsin commercial whitefish fishery has increased slightly over the last decade, but remain well below historic high levels. The increase in incidental kill is related to the increased level of gear being fished to catch the increased whitefish quota. This past season documented a rather substantial shift in gear utilized to target whitefish. As several additional licensees began fishing trap nets instead of gill nets, trap net effort for whitefish increased by over 60 percent while targeted gill net effort decreased by over 20 percent. If this shift in gear trend holds, it is likely that the incidental kill of salmonids will actually decrease while whitefish harvest continues to increase.

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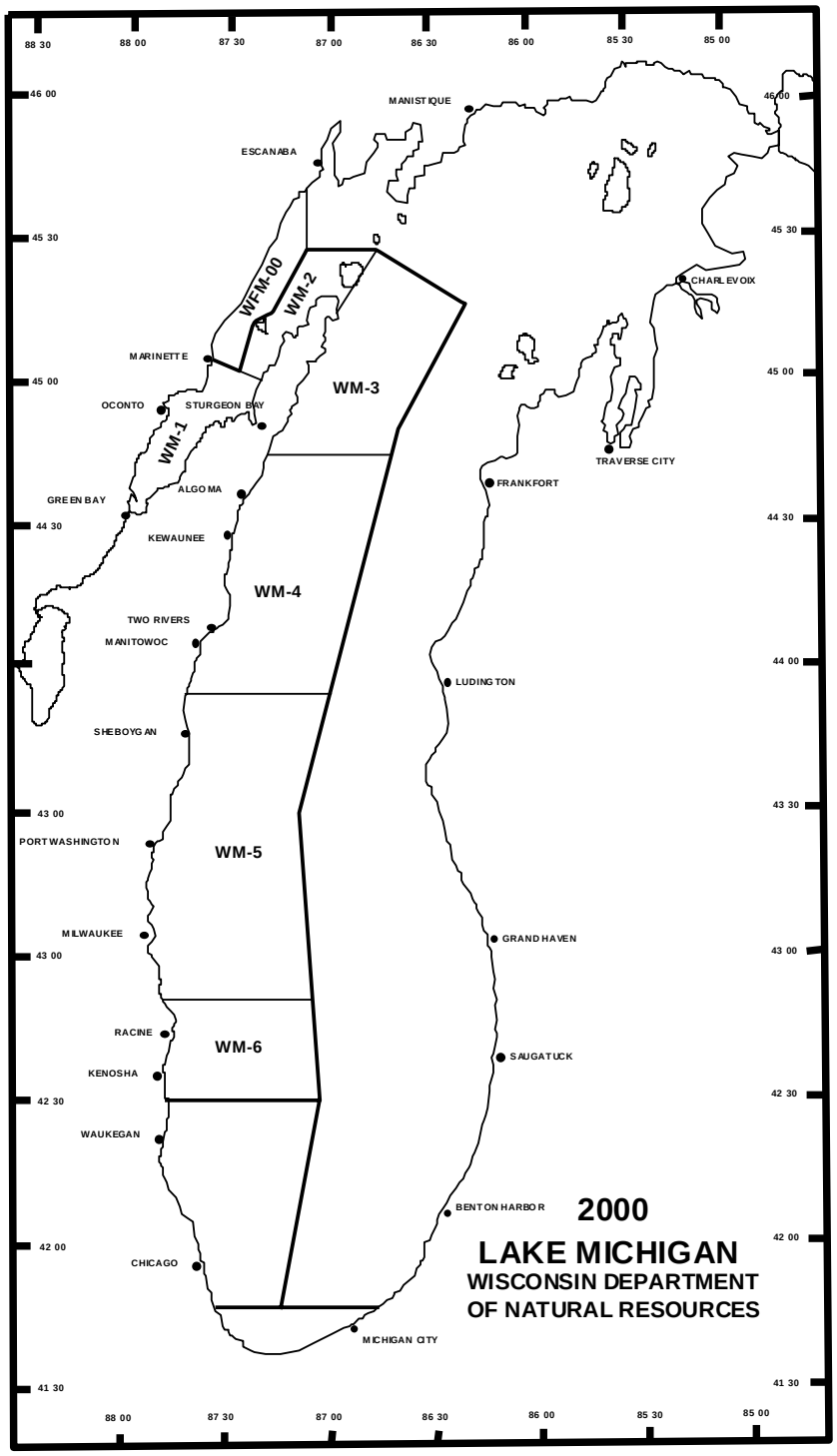


Figure 1.-Location of Wisconsin statistical districts (WM1-WM6), and Michigan whitefish management zone (WFM-00). Wisconsin commercial fishing zone 1 = WM-1, zone 2 = WM-2 and WM-3, and zone 3 = WM4, WM5, and WM6.

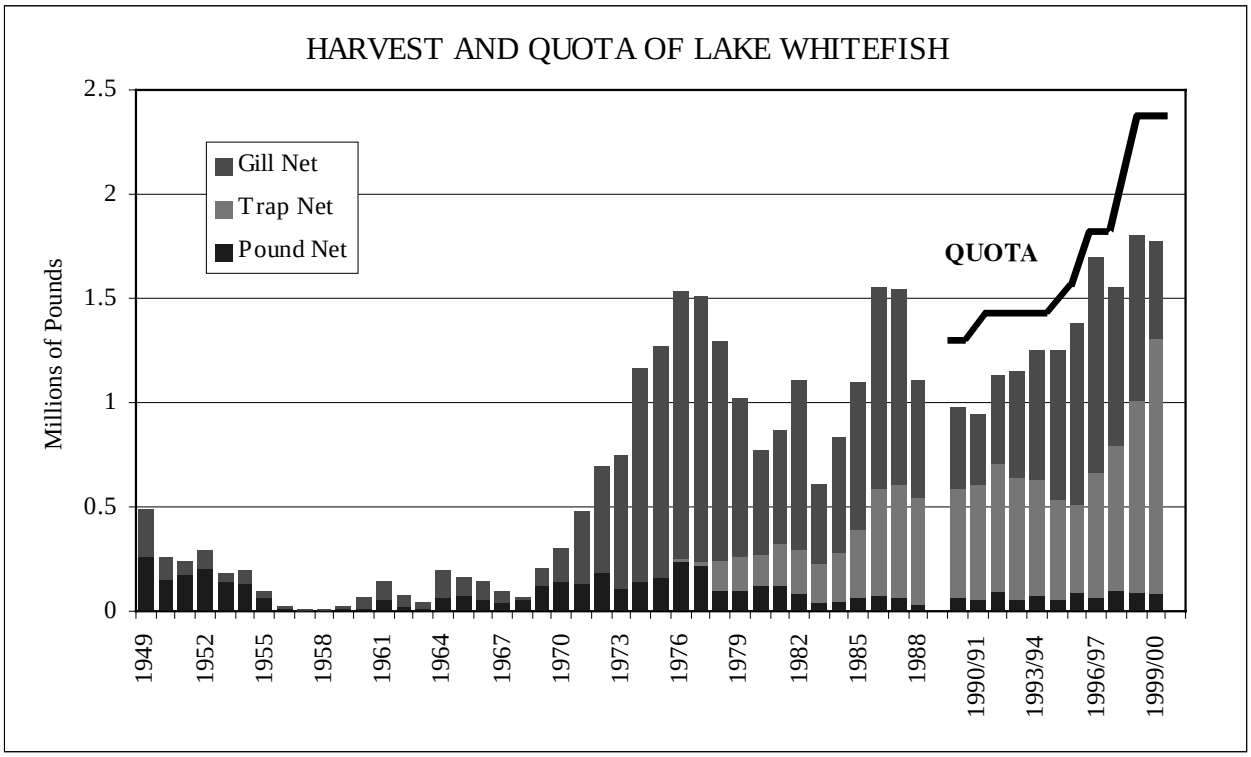


Figure 2.-Lake Whitefish reported commercial harvest by gear in pounds (dressed weight) from Wisconsin waters of Lake Michigan including Green Bay, from 1949 through 2000. (Calendar years 1949 through 1988; quota years 1989-90 through 1999-2000).

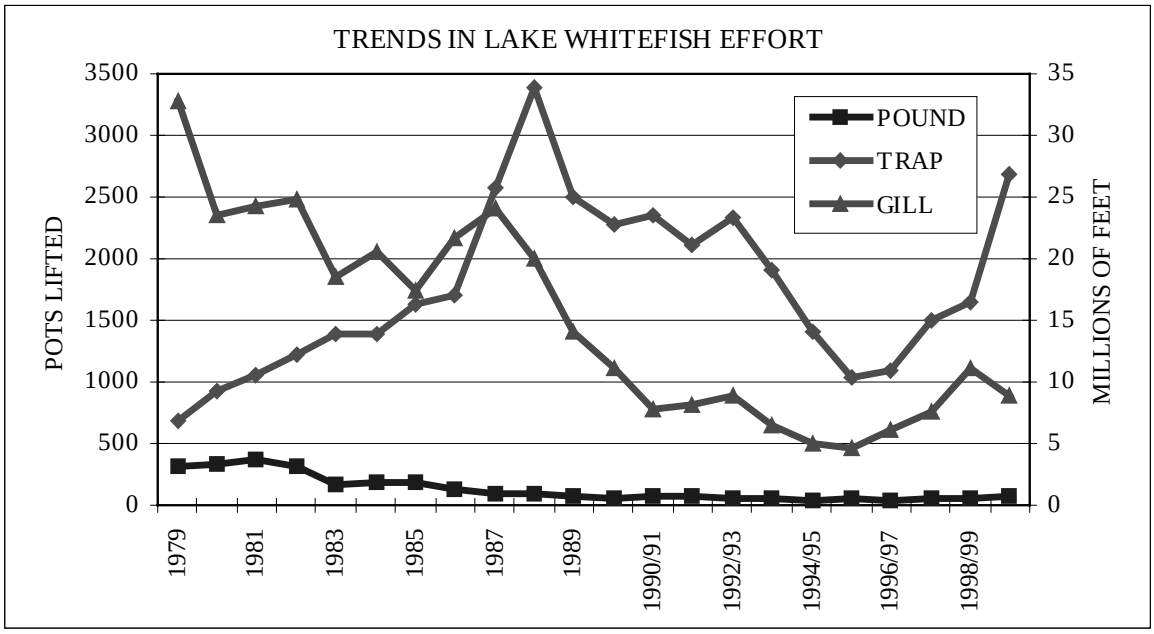


Figure 3.-Trends in gill net, trap net, and pound net effort fished for lake whitefish in Wisconsin waters of Lake Michigan, including Green Bay, 1979 through 2000. (Gill net effort = millions of feet; trap net and pound net effort = number of pots lifted).

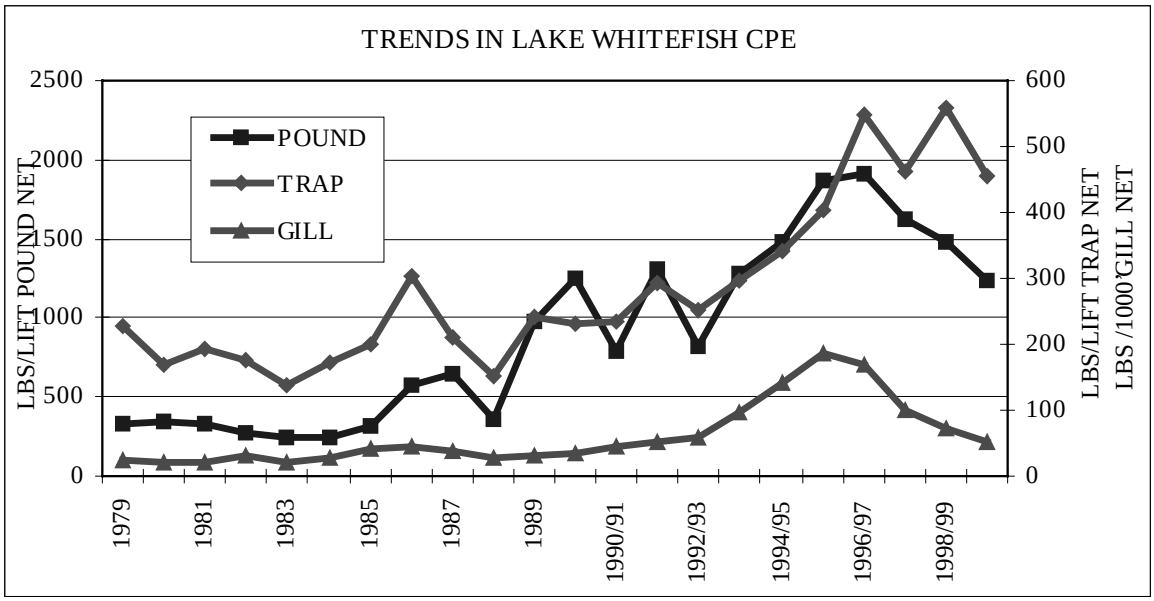


Figure 4.-Trends in gill net, trap net, and pound net lake whitefish commercial catch per effort (CPE) in the Wisconsin waters of Lake Michigan including Green Bay, 1979 through 2000. (Gill net CPE = pounds of whitefish harvested per 1,000 feet lifted; trap net and pound net CPE = pounds of whitefish harvested per pot lifted).

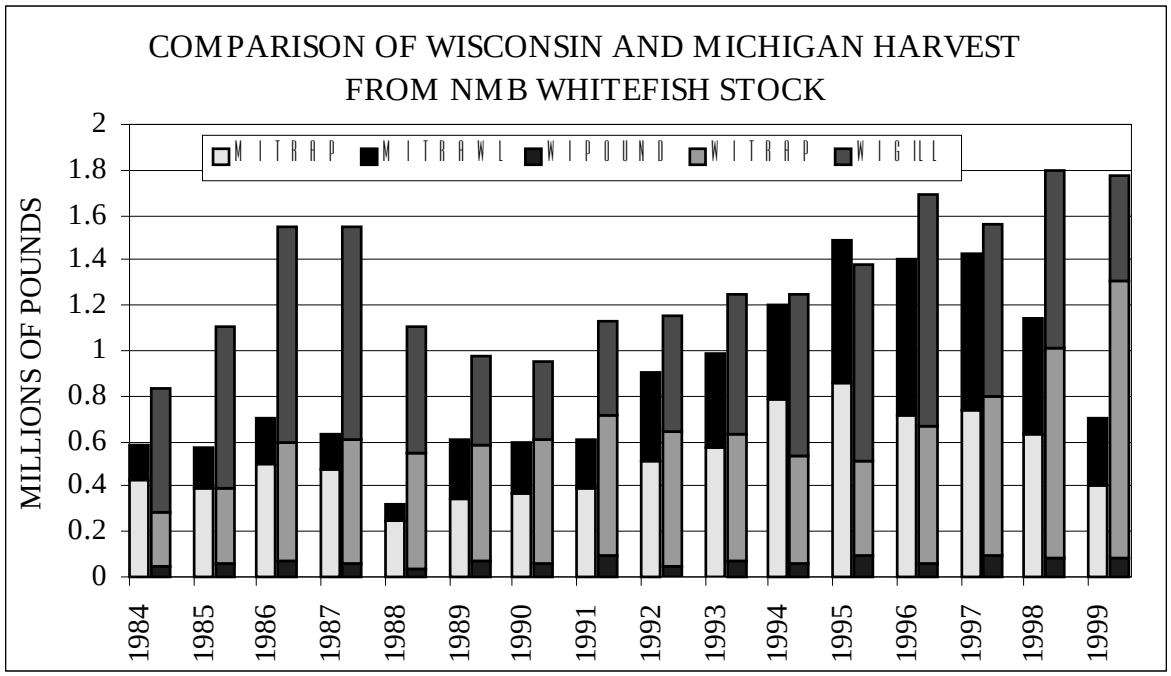
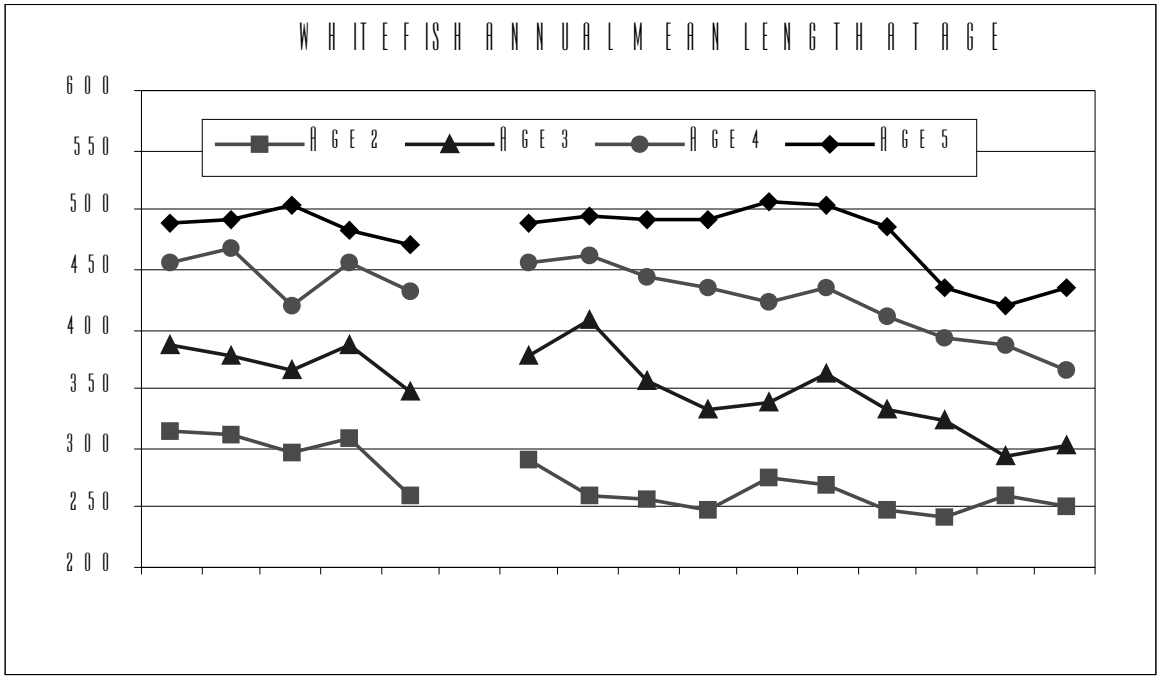


Figure 5.-Commercial harvest of the North/Moonlight Bay stock of lake whitefish, by gear, in the Wisconsin waters of Lake Michigan, including Green Bay, and a portion of the Michigan waters of Green Bay (WFM 00), calendar year 1984 – 1999. Wisconsin harvest values beginning with 1989 are actually license year totals (i.e. 1989 = license year 1989-90).



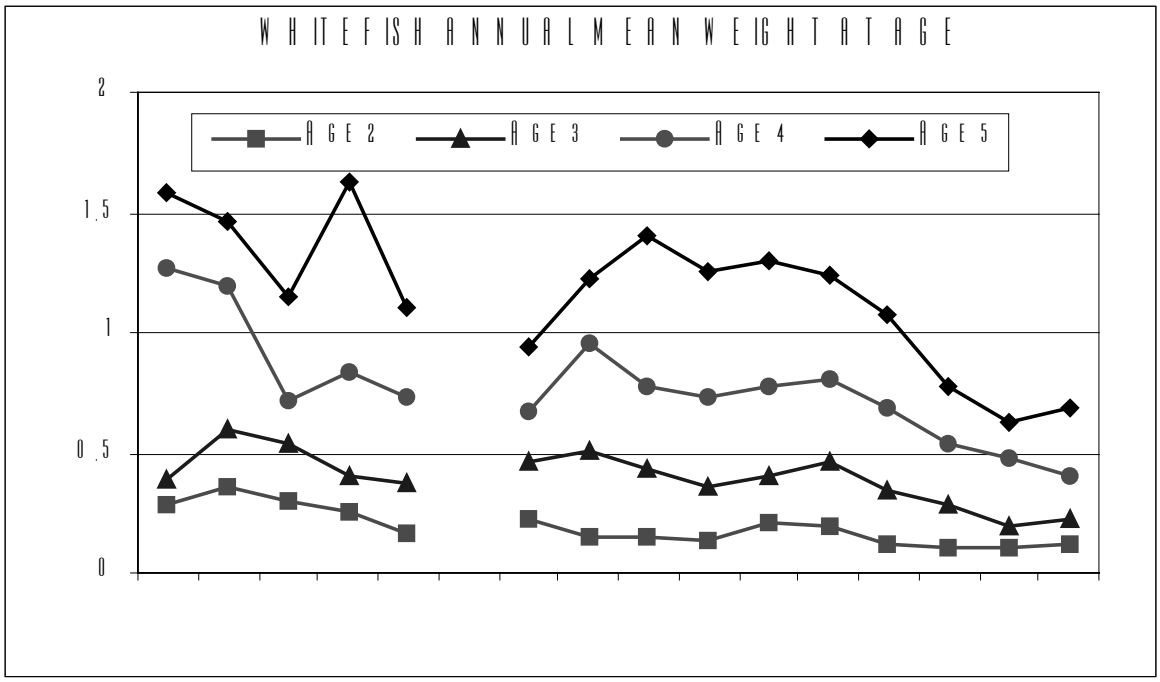


Figure 6.-Mean length and mean weight of lake whitefish, at age, in spring, from the North/Moonlight Bay population, 1985-2000.

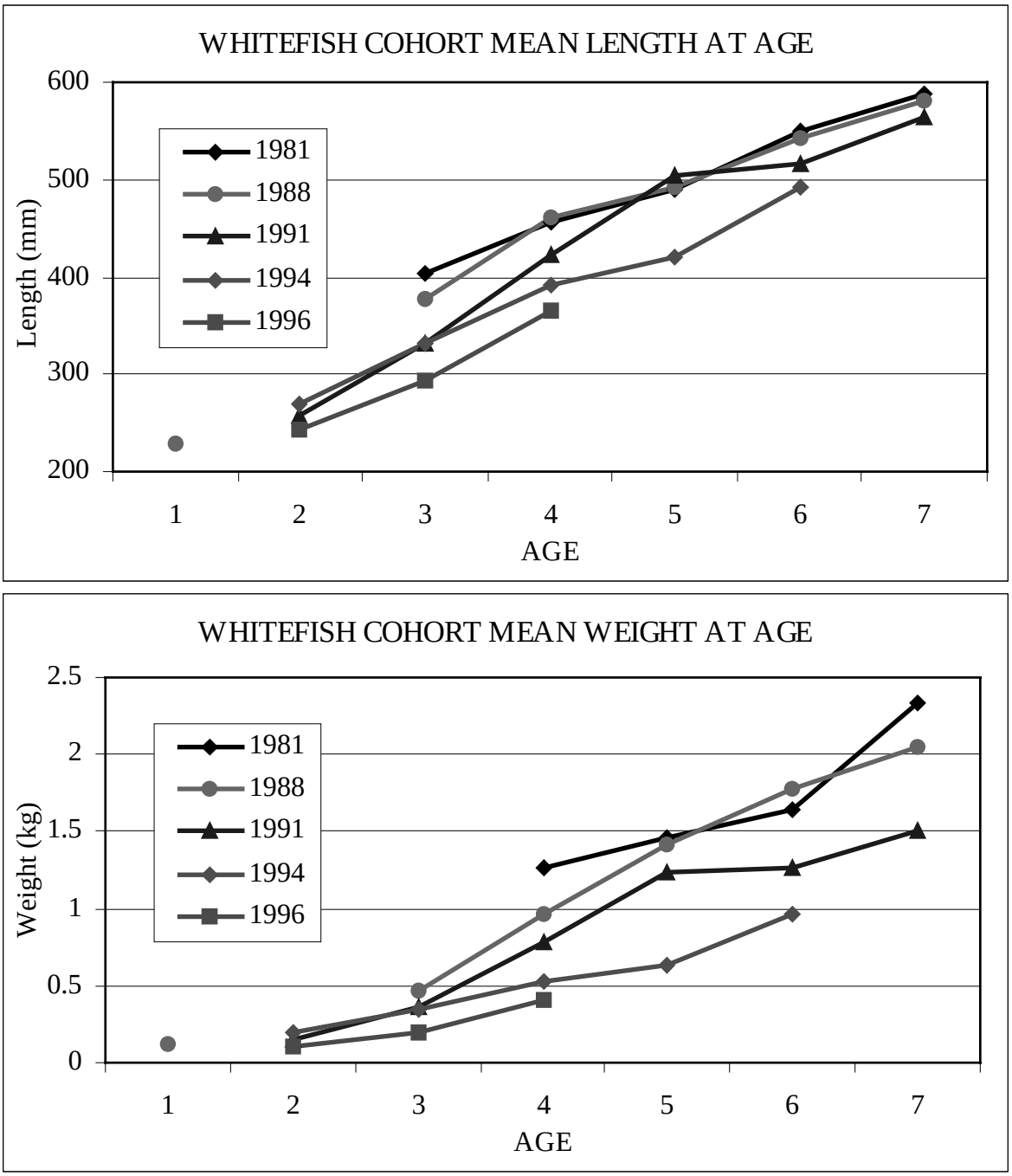


Figure 7.-Comparison of the spring time, mean length and mean weight at age, of five cohorts from the North/Moonlight Bay stock of lake whitefish, 1981, 1988, 1991, 1994, and 1996.

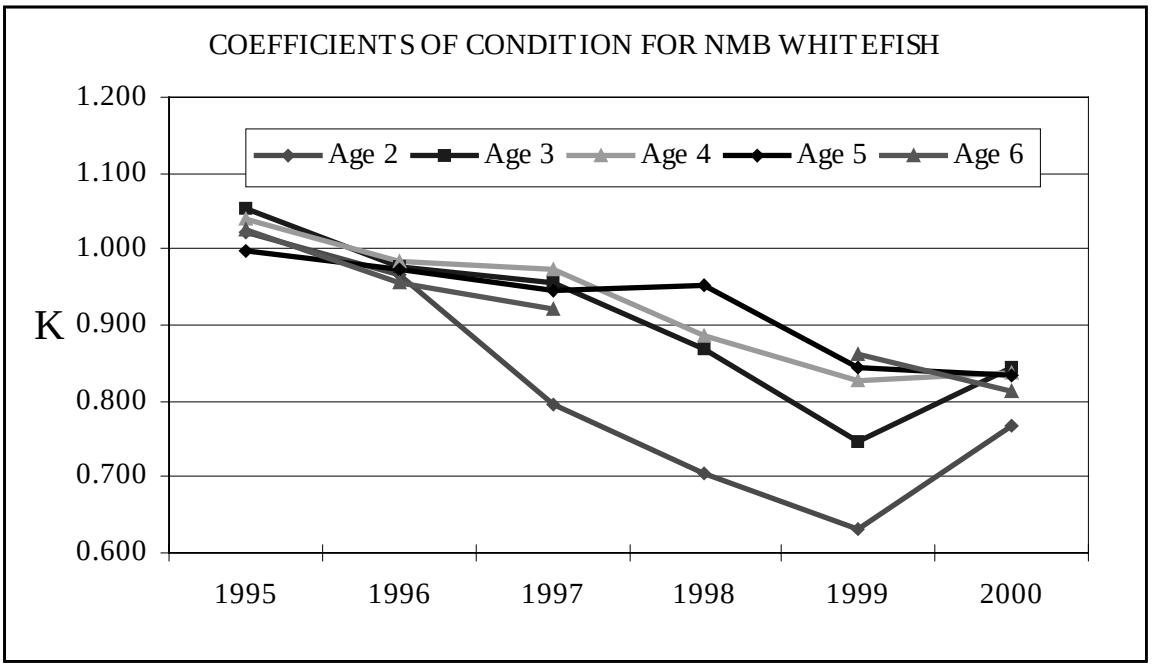


Figure 8.-Condition of lake whitefish from the NMB stock 1995 through 2000. Condition (K) as used in this context is a measure of the relative plumpness of the fish. To avoid possible variations caused by gonad development or condition, only whitefish sampled in spring were utilized for this analysis. Calculations were based on whitefish caught on Lake Michigan near Baileys Harbor and whitefish sampled during commercial monitors.

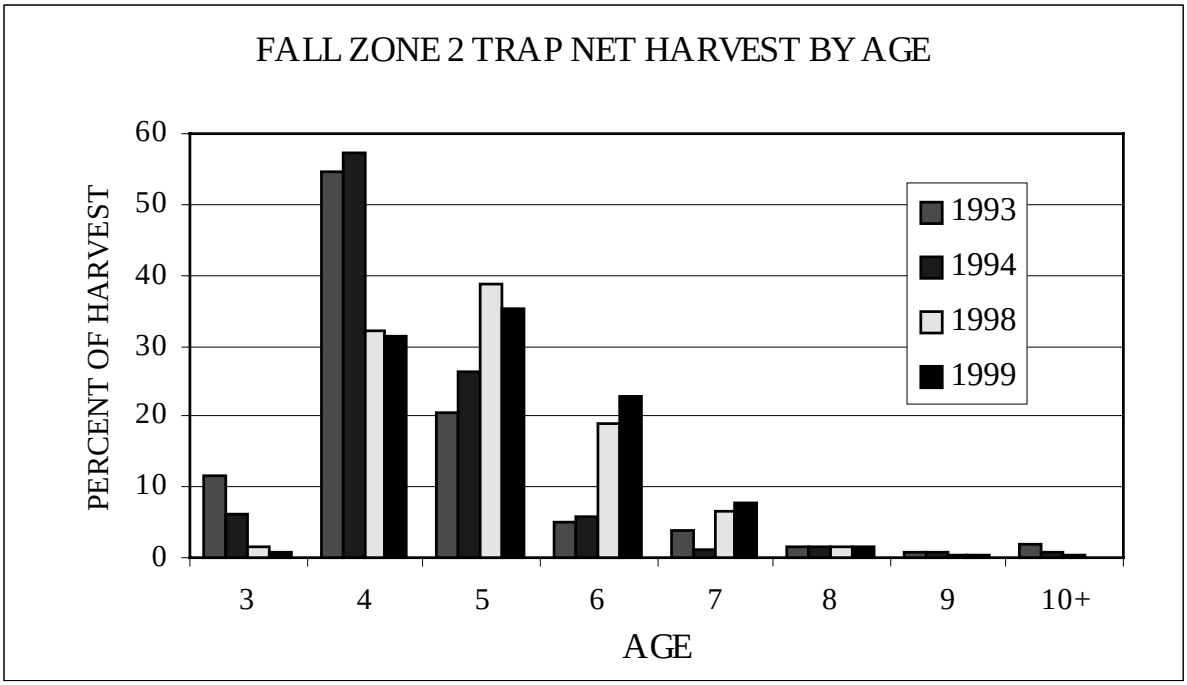


Figure 9.-Comparison of the estimated age composition of the commercial lake whitefish harvest in Zone two trap nets during the fall, 1993,1994, 1998, and 1999.

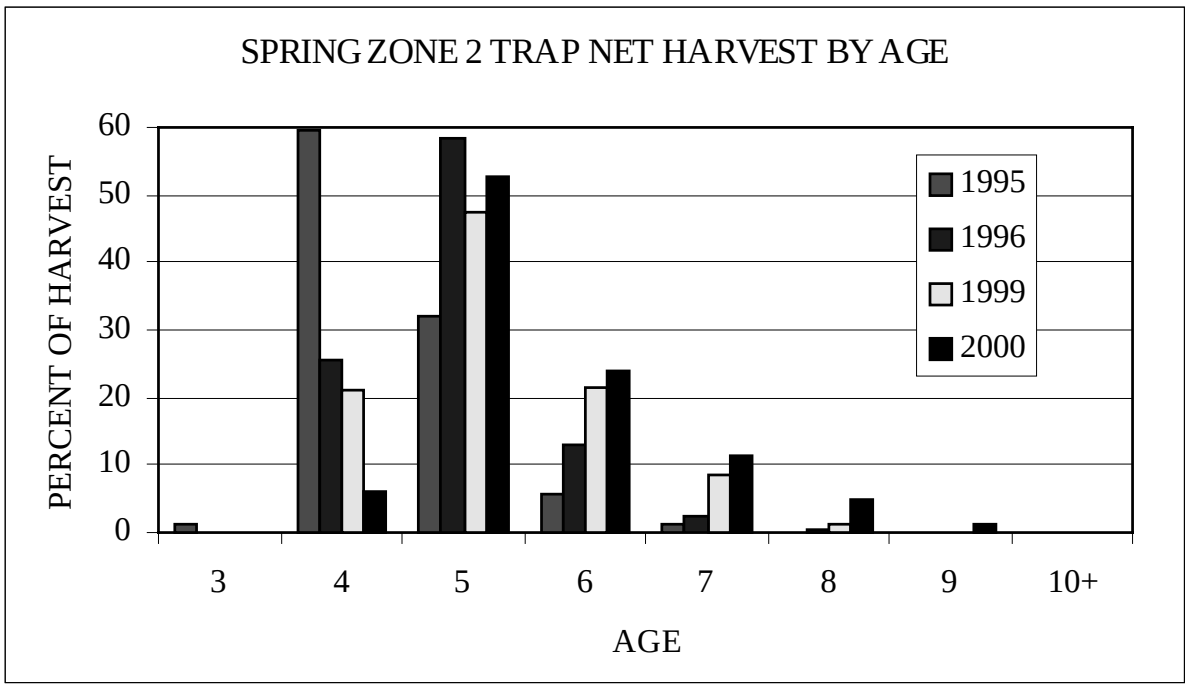


Figure 10.-Comparison of the estimated age of the lake whitefish harvested in the commercial trap net fishery in zone two during spring 1995, 1996, 1999, and 2000.

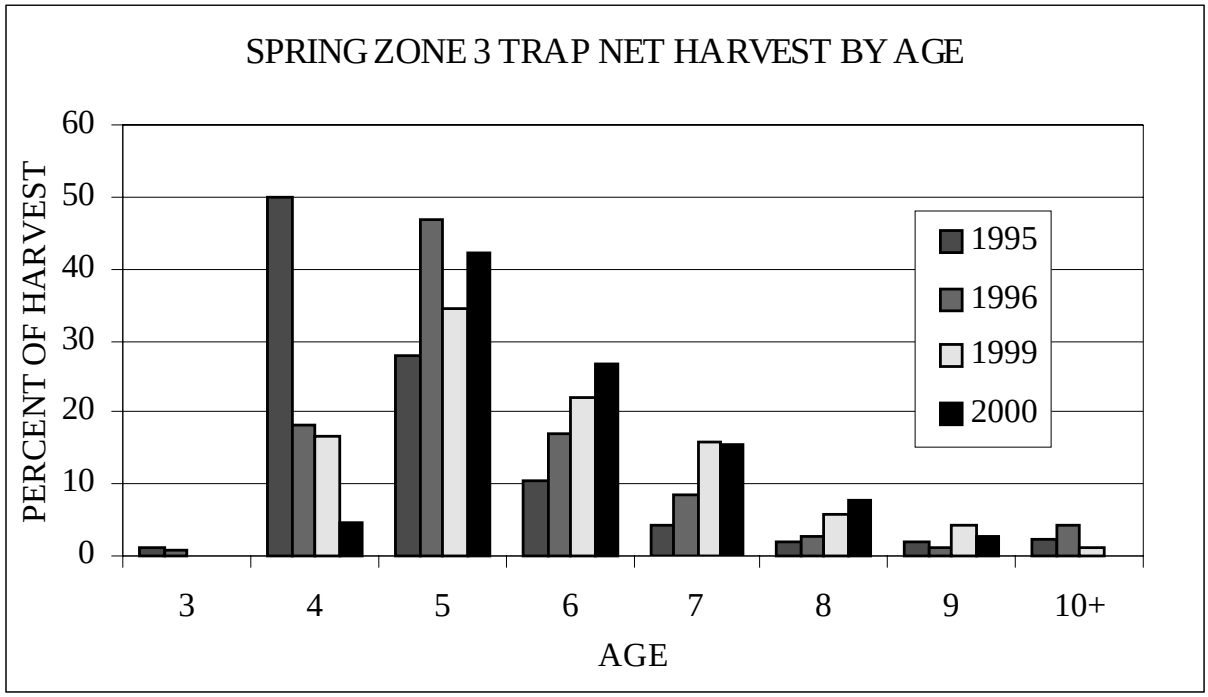


Figure 11.-Comparison of the estimated age of the lake whitefish harvested in the commercial trap net fishery in zone three during spring 1995, 1996, 1999, and 2000.

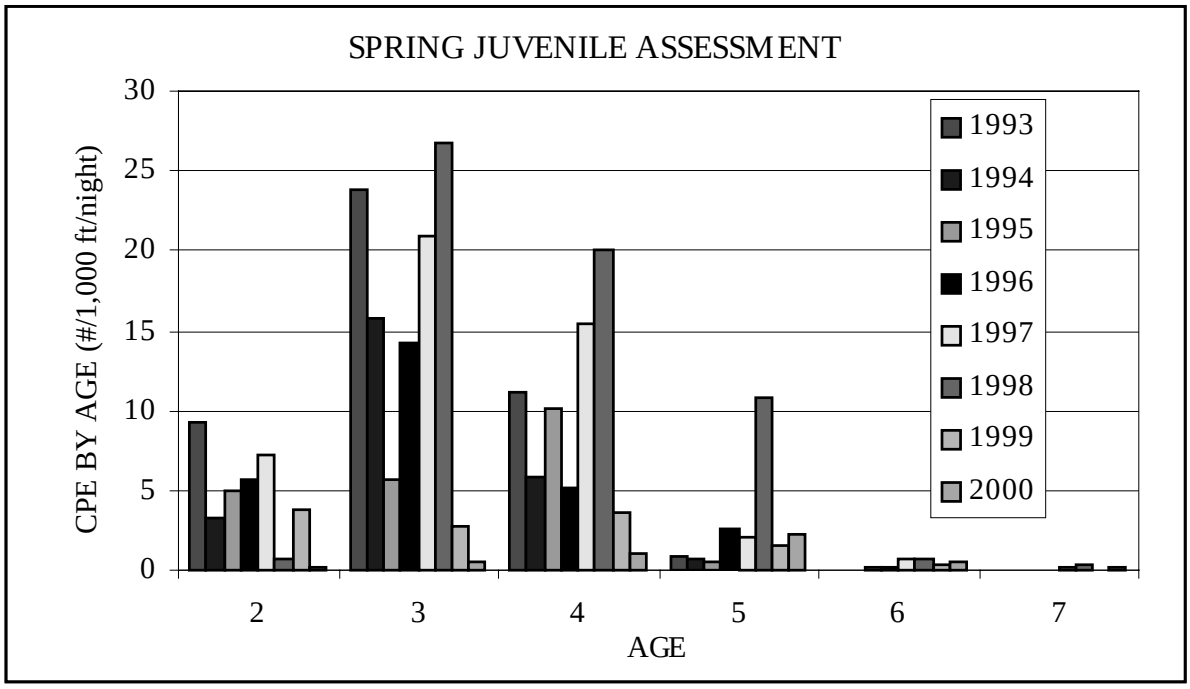


Figure 12.-Catch per unit of effort (CPE) of whitefish sampled during the spring juvenile graded mesh gill net assessment 1993 through 2000. Fished from the RV/BD in grid 706 near Baileys Harbor, WI.

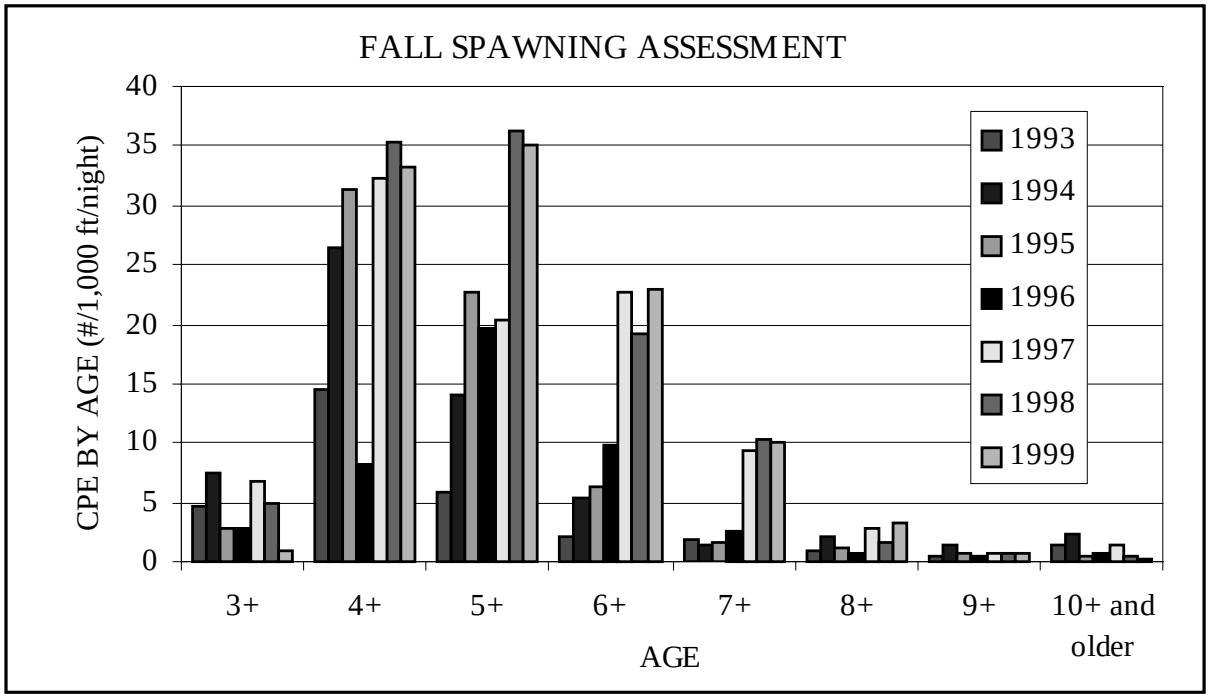


Figure 13.-Catch per unit of effort (CPE) of whitefish sampled during the fall spawning graded mesh gill net assessment 1993 through 1999. Fished from the RV/BD in grid 706 near Baileys Harbor, WI.

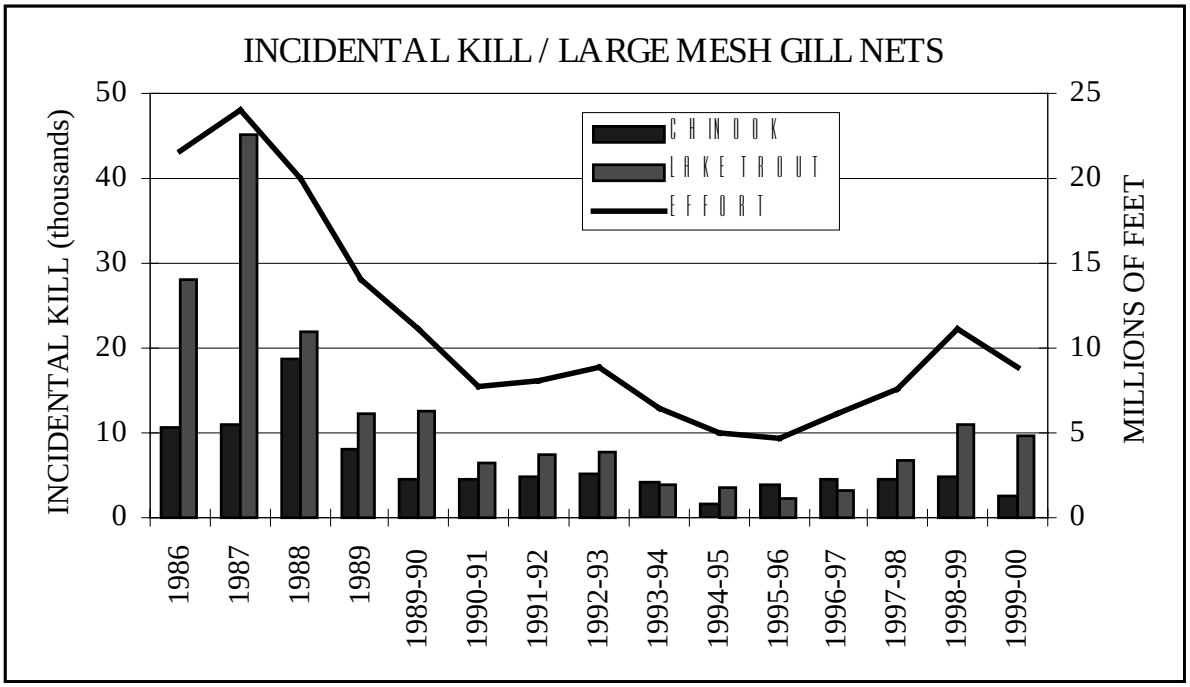


Figure 14.-Trends in the incidental kill of chinook salmon and lake trout in large mesh gill net fished for lake whitefish in the Wisconsin waters of Lake Michigan including Green Bay calendar year 1986 through license year 1999-2000.

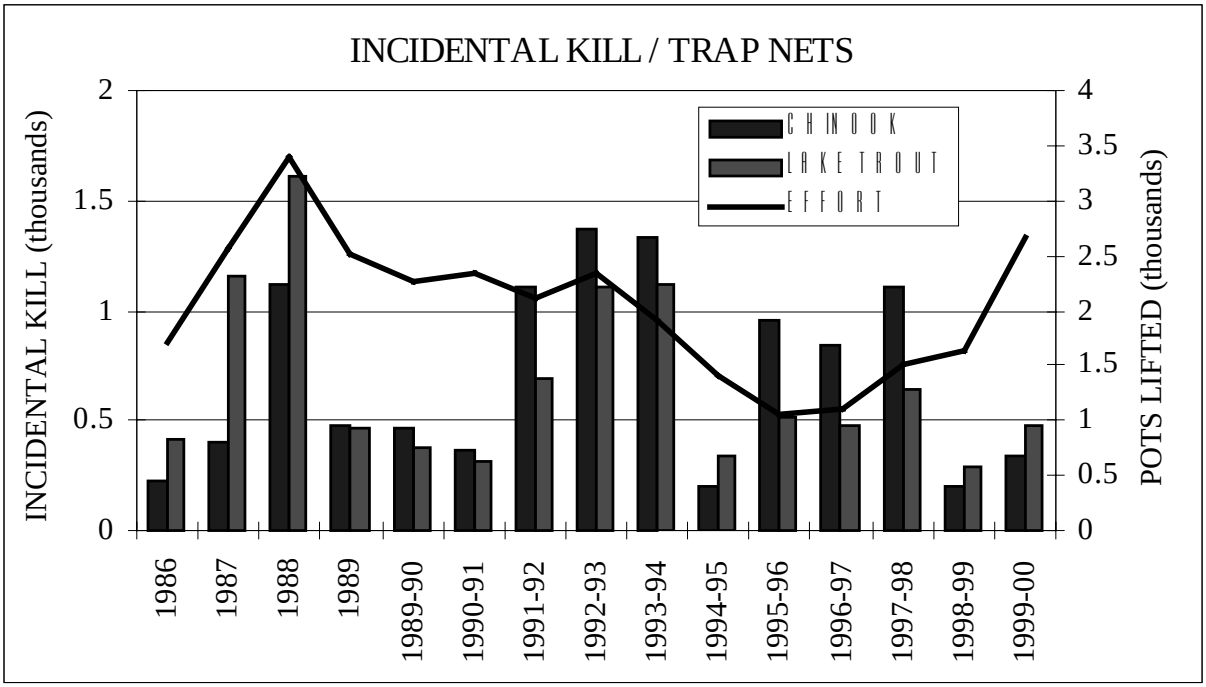


Figure 15.-Trends in the incidental kill of chinook salmon and lake trout in trap nets fished for lake whitefish in the Wisconsin waters of Lake Michigan including Green Bay calendar year 1986 through license year 1999-2000.

Table 1.-Wisconsin commercial lake whitefish harvest and quota by Zone for quota years 1989-90 through 1999-00.

Quota Year	Zone 1			Zone 2			Zone 3			Total		
	Allocated Quota	Pounds Harvest	Percent Harvested	Allocated Quota	Pounds Harvest	Percent Harvested	Allocated Quota	Pounds Harvest	Percent Harvested	Allocated Quota	Pounds Harvest	Percent Harvested
1989-90	105,000	65,627	63 %	945,000	841,702	89 %	100,000	78,502	79 %	1,150,000	985,831	86 %
1990-91	105,000	70,872	67 %	945,000	836,633	89 %	100,000	51,323	51 %	1,150,000	958,828	83 %
1991-92	118,695	71,793	61 %	1,068,255	971,952	91 %	113,050	90,335	80 %	1,300,000	1,134,080	87 %
1992-93	118,695	86,486	73 %	1,068,255	953,825	89 %	113,050	101,941	90 %	1,300,000	1,142,252	88 %
1993-94	118,695	106,846	90 %	1,068,255	1,052,823	99 %	113,050	93,894	83 %	1,300,000	1,253,563	96 %
1994-95	118,695	104,524	88 %	1,068,255	1,065,889	100 %	113,050	84,561	75 %	1,300,000	1,254,974	97 %
1995-96	132,390	129,303	98 %	1,191,510	1,172,344	98 %	126,100	76,430	61 %	1,450,000	1,378,077	95 %
1996-97	161,606	153,655	95 %	1,454,454	1,404,246	97 %	153,940	137,451	89 %	1,770,000	1,695,352	96 %
1997-98	161,606	126,043	78 %	1,454,454	1,277,246	88 %	153,940	153,652	100 %	1,770,000	1,556,941	88 %
1998-99	225,516	143,225	64 %	2,029,644	1,474,605	73 %	214,840	182,486	85 %	2,470,000	1,800,316	73 %
1999-00	225,516	57,681	26 %	2,029,644	1,517,163	75 %	214,840	193,592	90 %	2,470,000	1,768,436	72 %
2000-01	225,516			2,029,644			214,840			2,470,000		

Table 2.-Wisconsin commercial catch data for whitefish from the Wisconsin waters of Lake Michigan including Green Bay by gear, statistical district, and zone for quota years 1989-90 through 1999-00. Catch = pounds of dressed whitefish; Effort = pots lifted for pound nets and trap nets and 1,000s of feet lifted for gill net; Catch per effort (CPE) = pounds per lift.

YEAR		Zone1		Zone 2					Zone3		Total all Districts		
		WM 1		WM 2		WM 3			WM 4	WM 5			
		Trap	Gill	Trap	Gill	Pound	Trap	Gill	Trap	Trap	Pound	Trap	Gill
1989-90	Catch	31,105	34,017	21,257	197,561	66,316	392,994	159,216	42,793	35,252	66,316	523,401	390,794
	Effort	473	1,099.7	165	6,601.1	53	1,234	3,402.9	246	153	53	2,271	11,103.7
	CPE	65.8	30.9	128.8	29.9	1,251.2	318.5	46.8	174.0	230.4	1,251.2	230.5	35.2
1990-91	Catch	27,993	42,507	31,575	185,918	56,296	442,686	112,316	20,059	30,705	56,296	553,018	340,741
	Effort	372	802.7	313	4,811.8	66	1,327	2,117.0	168	169	66	2,349	7,731.5
	CPE	92.4	53.0	100.9	38.6	853.0	342.4	53.1	119.4	181.7	853.0	235.4	44.1
1991-92	Catch	30,261	41,532	37,003	285,168	95,621	455,843	98,317	66,079	24,256	95,621	613,442	425,017
	Effort	267	761.8	298	4,949.8	73	1,165	2,410.4	165	210	73	2,105	8,112.0
	CPE	113.3	54.5	124.2	57.6	1,309.9	391.3	40.8	400.5	115.5	1,309.9	291.4	52.4
1992-93	Catch	20,586	65,900	38,563	303,825	51,261	424,902	135,274	71,522	30,419	51,261	585,992	515,693
	Effort	279	922.5	302	5,355.0	63	1,427	2,484.7	223	111	63	2,342	8,762.2
	CPE	73.8	71.4	127.7	56.7	813.7	297.8	58.7	320.7	274.0	813.7	250.2	58.9
1993-94	Catch	38,979	67,867	30,257	459,250	70,192	401,063	92,061	68,887	25,007	70,192	564,193	619,178
	Effort	235	669.5	232	4,592.6	55	1,039	1,232.5	224	181	55	1,911	6,494.6
	CPE	165.9	101.4	130.4	100.0	1,276.2	386.0	74.7	307.5	138.2	1,276.2	295.2	95.3
1994-95	Catch	8,033	96,491	44,681	488,965	59,428	341,164	131,651	65,888	87,673	59,428	478,439	717,107
	Effort	56	797.0	160	3,138.3	40	975	1,134.4	168	49	40	1,408	5,069.7
	CPE	143.4	121.1	279.3	155.8	1,485.7	349.9	116.1	392.2	381.1	1,485.7	339.8	141.4
1995-96	Catch	198	129,105	29,839	603,899	89,538	316,484	132,584	54,569	21,861	89,538	422,951	865,588
	Effort	5	965.2	90	2,764.6	48	644	932.7	241	68	48	1,048	4,662.5
	CPE	39.6	133.8	331.5	218.4	1,865.4	491.4	142.2	226.4	321.5	1,865.4	403.6	185.6
1996-97	Catch	0	153,655	37,056	658,460	62,905	427,807	218,018	84,387	53,064	62,905	602,314	1,030,133
	Effort	0	1,515.5	94	3,350.2	33	741	1,233.8	208	53	33	1,096	6,099.5
	CPE	0	101.4	394.2	196.5	1,906.2	577.3	176.7	405.7	1,001.2	1,906.2	549.6	168.9
1997-98	Catch	0	126,043	53,316	303,140	97,614	487,980	335,196	96,919	56,733	97,614	694,948	764,379
	Effort	0	1,483.1	112	3,161.6	60	1,048	2,952.4	267	76	60	1,503	7,597.1
	CPE	0	85.0	263.9	95.9	1,626.9	465.6	113.5	363.0	746.5	1,626.9	462.4	100.6
1998-99	Catch	0	143,225	38,654	121,513	85,798	699,687	528,953	129,877	52,609	85,798	920,827	793,691
	Effort	0	2,099.6	168	2,885.1	58	1,137	6,143.3	226	116	58	1,647	11,128
	CPE	0	68.2	230.1	42.1	1,479.3	615.4	86.1	574.7	453.5	1,479.3	559.1	71.3
1999-00	Catch	0	57,681	30,545	41,361	86,742	998,237	360,278	135,142	58,450	86,742	1,222,374	459,320
	Effort	0	1,755.3	93	1,513	70	2,225	5,507.1	261	104	70	2,683	8,775.4
	CPE	0	32.9	328.4	27.3	1,239.2	448.6	65.4	517.8	562.0	1,239.2	455.6	52.3

Table 3.-Lake whitefish harvest (dressed weight in pounds) and effort by gear in the state of Michigan waters of Green Bay (WFM-00), calendar years 1989 through 1999.

YEAR		TRAP NET HARVEST	TRAWL HARVEST	TOTAL FOR YEAR
1989	Catch	350,084 pounds	252,874 pounds	602,958 pounds
	Effort	2,612 lifts	368 hours	
	CPE	134.0 per lift	687.2 per hour	
1990	Catch	375,160 pounds	220,572 pounds	595,732 pounds
	Effort	1,626 lifts	703 hours	
	CPE	230.7 per lift	313.8 per hour	
1991	Catch	396,075 pounds	213,084 pounds	609,541 pounds[1]
	Effort	1,468lifts	564 hours	
	CPE	269.8 per lift	377.8 per hour	
1992	Catch	510,026 pounds	398,847 pounds	908,873 pounds
	Effort	1,620 lifts	948 hours	
	CPE	314.8 per lift	420.7 per hour	
1993	Catch	567,089 pounds	423,733 pounds	990,822 pounds
	Effort	1,698 lifts	984 hours	
	CPE	334.0 per lift	430.6 per hour	
1994	Catch	788,694 pounds	408,773 pounds	1,197,466 pounds[2]
	Effort	1,913 lifts	874 hours	
	CPE	412.3 per lift	467.7 per hour	
1995	Catch	855,369 pounds	636,217 pounds	1,508,226 pounds[3]
	Effort	2,037 lifts	1,125 hours	
	CPE	419.9 per lift	565.5 per hour	
1996	Catch	712,834 pounds	688,604 pounds	1,401,438 pounds
	Effort	1,570 lifts	1,021 hours	
	CPE	454.0 per lift	674.4 per hour	
1997	Catch	773,392 pounds	690,358 pounds	1,463,750 pounds
	Effort	2,154 lifts	1,060 hours	
	CPE	359.0 per lift	651.3 per hour	
1998	Catch	628,109 pounds	511,732 pounds	1,139,841 pounds
	Effort	1,644 lifts	940 hours	
	CPE	382.1 per lift	544.4 per hour	
1999	Catch	407,216 pounds	296,338 pounds	703,554 pounds
	Effort	1,184 lifts	623 hours	
	CPE	343.9 per lift	475.7 per hour	

[1] includes 382 pounds of whitefish caught in pound nets.
[2] includes 455 pounds of whitefish caught in pound nets.
[3] includes 8,321 pounds of whitefish caught in pound nets.

Table 4.-Mean length (mm) and weight (kg) at age in spring of lake whitefish sampled from WDNR assessments and various commercial gear fished in the Wisconsin waters of Lake Michigan, 1984-2000, listed by age in the year sampled. Year class of the cohort described at age within a given survey year can be identified by following the shaded diagonal table cells.

YEAR		AGE													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1984	l		307	403	467	536	581	626	655	676	699	691	723		
	w	No fish weighed in 1984													
1985	l		313	386	456	490	538	582	652	670	678	715	727	716	705
	w		0.28	0.39	1.27	1.58	1.97	2.33	2.68	3.03	3.61	3.62	4.18	3.72	4.38
1986	l	234	312	378	467	491	562	602	629	659	681	701	701	715	727
	w	0.14	0.36	0.59	1.19	1.46	1.87	2.27	2.57	2.95	3.27	4.06	3.78	3.70	4.75
1987	l	226	296	364	420	503	549	611	633	657	682	682	705	704	732
	w	0.14	0.30	0.53	0.71	1.15	1.64	2.35	2.72	3.29	3.64	3.47	3.25	4.25	4.82
1988	l		308	387	455	483	548	589	639	662	684	703	708	710	746
	w		0.25	0.40	0.84	1.62	1.87	2.33	2.65	3.13	3.45	3.75	3.46	3.63	
1989	l	228	259	347	431	471	522	593	620	660	690	713	720	724	731
	w	0.12	0.16	0.37	0.73	1.11	1.48	2.12	2.51	3.04	3.65	4.02	4.24	4.01	4.23
1990	l	No fish sampled in 1990													
	w														
1991	l	223	291	377	455	488	525	519	601	644		692		737	
	w	0.12	0.23	0.46	0.67	0.94	0.99								
1992	l		260	407	462	494	550	595	613	633	663	688	700	704	689
	w		0.15	0.51	0.96	1.22	1.57	2.00	2.32	2.48	3.02	3.19	3.68	3.78	3.35
1993	l		258	357	444	492	561	599	628	645	662	681	706	718	716
	w		0.15	0.43	0.77	1.41	1.82	2.08	2.37	2.76	3.14	3.31	3.95	4.22	4.13
1994	l		249	332	435	493	543	591	618	645	646	669	687	700	718
	w		0.14	0.36	0.73	1.25	1.78	2.15	2.47	2.79	2.97	3.08	3.48	3.82	4.06
1995	l		274	339	422	507	558	582	640	649	660	648	680	707	707
	w		0.21	0.41	0.78	1.30	1.78	2.05	2.69	2.90	3.03	2.95	3.43	3.98	4.06
1996	l		270	361	435	503	557	594	611	636	671	684	701	681	717
	w		0.19	0.46	0.81	1.24	1.65	2.02	2.27	2.61	3.08	3.27	3.45	3.16	3.92
1997	l		247	332	412	485	515	551	567	587					
	w		0.12	0.35	0.68	1.08	1.26	1.55	1.66	1.86					
1998	l		242	322	391	434		564	587						
	w		0.10	0.29	0.53	0.78		1.5	1.85						
1999	l		259	294	387	421	429								
	w		0.11	0.19	0.48	0.63	0.68								
2000	l		250	301	366	436	492	539	582	605					
	w		0.12	0.23	0.41	0.69	0.97	1.28	1.71	1.84					

Table 5.-Age composition of lake whitefish captured in graded mesh gill nets during spring assessments near Baileys Harbor (grid 706), 1987 through 2000 (CPE = Number /1,000 feet of net/night).

YEAR	LOCATION	PERCENT	AGE						
	NUMBER AGED	CPE	1	2	3	4	5	6	7
1987	GRID 706	PERCENT	0.0	55.7	7.2	33.0	3.9	0.0	0.0
	401 AGED	CPE	0.0	13.8	1.8	8.1	1.0	0.0	0.0
1988	GRID 706	PERCENT	0.0	10.5	73.3	5.8	10.5	0.0	0.0
	88 AGED	CPE	0.0	0.6	4.3	0.3	0.6	0.0	0.0
1989	GRID 706	PERCENT	0.8	23.4	41.1	27.4	2.6	3.7	0.8
	248 AGED	CPE	0.1	4.0	7.1	4.7	0.5	0.6	0.1
1990	GRID 706	PERCENT	0.2	35.7	36.4	23.0	4.0	0.1	0.0
	692 AGED	CPE	0.1	18.7	19.1	12.1	2.2	0.1	0.0
1991	GRID 706	PERCENT	1.5	48.7	32.7	12.4	4.2	0.6	0.0
	250 AGED	CPE	0.3	8.5	5.7	2.2	0.8	0.1	0.0
1992	GRID 706	PERCENT	0.0	10.8	34.5	47.4	6.4	0.7	0.0
	46 AGED	CPE	0.0	0.3	1.1	1.5	0.2	0.0	0.0
1993	GRID 706	PERCENT	0.0	20.3	52.9	24.8	2.0	0.0	0.0
	649 AGED	CPE	0.0	9.2	23.8	11.2	0.9	0.0	0.0
1994	GRID 706	PERCENT	0.0	12.8	61.6	22.9	2.7	0.1	0.0
	739 AGED	CPE	0.0	3.3	15.8	5.9	0.7	0.03	0.0
1995	GRID 706	PERCENT	0.0	23.0	26.6	47.7	2.4	0.3	0.0
	666 AGED	CPE	0.0	4.9	5.7	10.2	0.5	0.1	0.0
1996	GRID 706	PERCENT	0.0	20.3	51.4	18.6	8.9	0.8	0.0
	665 AGED	CPE	0.0	5.6	14.2	5.2	2.5	0.2	0.0
1997	GRID 706	PERCENT	0.0	15.5	45.0	33.3	4.5	1.5	0.1
	669 AGED	CPE	0.0	7.2	20.9	15.5	2.1	0.7	0.1
1998	GRID 706	PERCENT	0.0	1.3	44.9	33.7	18.2	1.3	0.6
	713 AGED	CPE	0.0	0.7	26.7	20.0	10.8	0.7	0.3
1999	GRID 706	PERCENT	0.0	31.7	22.8	29.7	12.9	3.0	0.0
	202 AGED	CPE	0.0	3.8	2.7	3.6	1.5	0.4	0.0
2000	GRID 706	PERCENT	0.0	3.0	13.4	23.9	47.8	10.4	1.5
	66 AGED	CPE	0.0	0.1	0.6	1.1	2.2	0.5	0.1

Table 6.-Age composition of lake whitefish captured during the fall spawning assessment from Whitefish Point (grid 806) to Cana Island (grid 706) 1987-1999. Effort = feet of net x 1000, CPE = number of lake whitefish / 1000 feet of net night (adjusted for 300 feet of effort per night for each mesh, 3½, 4, 4½, 5, and 5½ inch stretch measure).

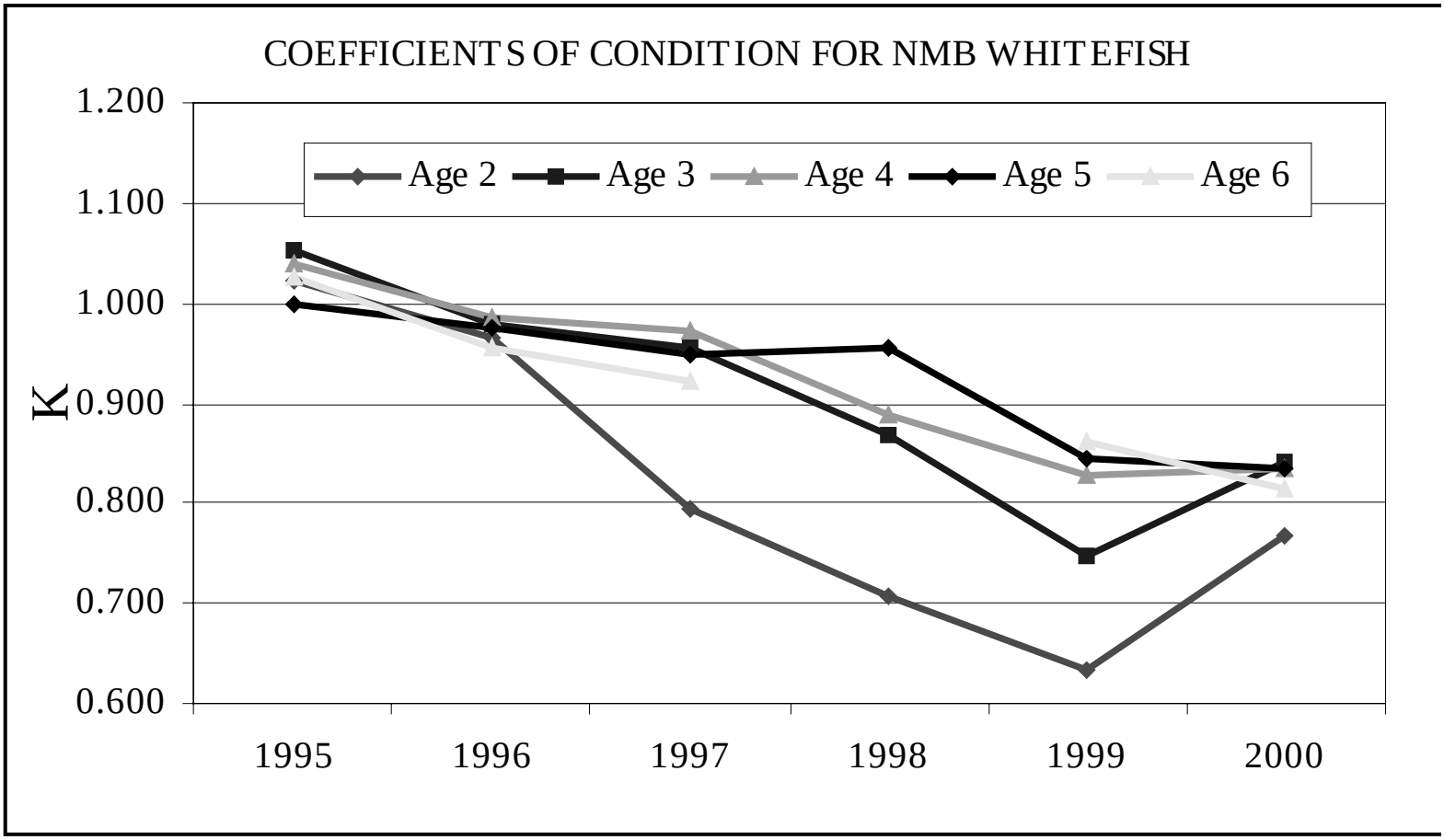
YEAR	Total Effort	Number by age	AGE												
	Total CPE	CPE By age	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14 +**
1987	6.6	N	2	4	72	253	33	12	4	4	1	0	1	0	0
N=368	55.8	CPE	0.3	0.6	10.9	35.6	5.0	1.8	0.6	0.6	0.2	0	0.2	0	0
1988	12.0	N	4	146	64	193	333	135	44	6	12	4	3	1	1
N=946	78.8	CPE	0.3	12.2	5.3	16.1	27.8	11.3	3.7	0.5	1.0	0.3	0.3	0.1	0.1
1989	24.0	N	3	131	256	45	48	44	21	6	2	2	2	0	1
N=561	23.4	CPE	0.1	5.5	10.7	1.9	2.0	1.8	0.9	0.3	0.1	0.1	0.1	0	0
1990	15.0	N	2	34	184	154	20	18	48	10	4	1	4	1	0
N=480	32.0	CPE	0.1	2.3	12.3	10.3	1.3	1.2	3.2	0.7	0.3	0.1	0.3	0.1	0
1991	15.0	N	27	173	181	113	39	3	12	9	2	1	0	0	0
N=560	37.3	CPE	1.8	11.5	12.1	7.5	2.6	0.2	0.8	0.6	0.1	0.1	0	0	0
1992	15.0	N	0	160	225	59	37	32	4	13	9	0	2	0	2
N=543	36.2	CPE	0	10.7	15.0	3.9	2.5	2.1	0.3	0.9	0.6	0	0.1	0	0.1
1993	18.0	N	0	85	262	107	36	35	18	9	11	7	2	2	1
N=575	31.9	CPE	0	4.7	14.5	5.9	2.0	1.9	1.0	0.5	0.6	0.4	0.1	0.1	0.1
1994	21.0	N	0	155	556	294	114	31	41	29	25	11	8	3	4
N=1,271	60.5	CPE	0	7.4	26.5	14.0	5.4	1.5	2.0	1.4	1.2	0.5	0.4	0.1	0.2
1995	12.0	N	0	32	376	271	74	20	13	7	6	0	0	0	0
N=799	66.7	CPE	0	2.7	31.3	22.6	6.2	1.7	1.1	0.6	0.5	0	0	0	0
1996	19.5	N	0	53	157	382	192	51	15	7	6	4	3	1	0
N=871	44.8	CPE	0	2.7	8.1	19.6	9.8	2.6	0.8	0.4	0.3	0.2	0.2	0.1	0
1997	18.0	N	0	124	581	368	407	167	52	11	9	6	4	3	3
N=1,735	96.4	CPE	0	6.9	32.3	20.4	22.6	9.3	2.9	0.6	0.5	0.3	0.2	0.2	0.2
1998	6.0	N	0	29	212	218	115	61	10	4	2	1	0	0	0
N=565	108.7	CPE	0	4.8	35.3	36.3	19.2	10.2	1.7	0.7	0.3	0.2	0	0	0
1999	9.0	N	0	10	300	316	207	90	29	6	1	1	0	0	0
N=815	106.6	CPE	0	1.0	33.3	35.1	23.0	10.0	3.2	0.7	0.1	0.1	0	0	0

Table 7.-Comparison of annual (A) and instantaneous (Z) mortality rates by age group and pooled years for whitefish in the North/Moonlight Bay stock. Whitefish were sampled in GMGN fished from the RV/BD during the annual fall spawning survey in Lake Michigan near Baileys Harbor (WM3) 1989-1999.

Pooled Years	Age Groups	Least Squares Regression		
		A	Z	r^2
1989-91	4-6	0.583	0.875	0.97
	7-12	0.458	0.613	0.89
	4-12	0.457	0.611	0.96
1990-92	4-6	0.600	0.916	0.92
	7-12	0.495	0.684	0.75
	4-12	0.483	0.659	0.91
1991-93	4-6	0.593	0.900	0.99
	7-12	0.394	0.500	0.93
	4-12	0.431	0.564	0.97
1995-97	5-8	0.580	0.868	0.97
	5-12	0.535	0.766	0.97
	4-12	0.514	0.722	0.97
1997-99	5-8	0.537	0.771	0.92
	5-12	0.575	0.855	0.97
	4-12	0.547	0.792	0.96

Table 8.-Estimated incidental kill of the three most common salmonids species associated with gear used by the Wisconsin commercial fisherman to harvest lake whitefish in the Wisconsin waters of Lake Michigan including Green Bay during license years 1989-90 and 1999-00. Data is arranged by year, by statistical district, by gear. Effort = amount of a particular type of gear fished in a particular year, in a specific statistical district (gill net in 1,000's of feet; trap net and pound net in pots lifted). All onboard commercial lifts monitored by WDNR staff during calendar years 1998-2000 were pooled to develop the catch per effort (CPE) (number of dead fish) for chinook salmon, brown trout, and lake trout. Additionally, trap net diving in WM3 during the summer of 1999 was used to estimate the incidental kill associated with trap net leads. The rate of kill in WM3 trap net leads was added to the documented kill rate established for trap net pots in each statistical district as no other trap net lead information was available.

ESTIMATED INCIDENTAL KILL OF SALMONIDS			Zone 1	Zone 2					Zone 3	Total Estimated Dead
			WM 1	WM 2		WM 3			WM 4 & WM 5	
			Gill Net	Gill Net	Trap Net	Gill Net	Trap Net	Pound Net	Trap Net	
1998 -99	Species	Effort	2,099.6	2,885.1	168	6,143.3	1,137	58	342	1998-99
	Chinook Salmon	CPE		1.528	0.100	0.047	0.127	0.200	0.124	4,912
		Dead		4,408	17	289	144	12	42	
	Brown Trout	CPE	0.385	0.052		0.054				1,290
		Dead	808	150		332				
	Lake Trout	CPE		0.104	0.009	1.723	0.169	0.200	0.284	11,188
		Dead		300	2	10,585	192	12	97	
1999 -2000	Species	Effort	1,755.3	1,513	93	5,507.1	2,225	70	347	1999-00
	Chinook Salmon	CPE		1.528	0.100	0.047	0.127	0.200	0.124	2,920
		Dead		2,312	9	259	283	14	43	
	Brown Trout	CPE	0.385	0.052		0.054				1,051
		Dead	675	79		297				
	Lake Trout	CPE		0.104	0.009	1.723	0.169	0.200	0.284	10,136
		Dead		157	1	9,489	376	14	99	


COEFFICIENTS OF CONDITION FOR NMB WHITEFISH
1.200
1.100
1.000
0.900
0.800
0.700
0.600
K
Age 2
Age 3
Age 4
Age 5
Age 6
1995
1996
1997
1998
1999
2000

estimated % age composition of the commercial trap net catch Fall Zone 2

	1993	1994	1995	1996	1997	1998	1999
2							
3	11.8	6.3	1	4.5	2.6	1.4	0.8
4	54.4	57.1	35.2	20.9	31.3	32.2	31.4
5	20.5	26.4	44.4	50.8	24.2	38.9	35.4
6	5.1	5.8	12.8	17	27.6	19.1	22.7
7	3.7	1.1	3.1	4.6	10.3	6.5	7.7
8	1.5	1.5	1.3	1.4	2.4	1.4	1.7
9	0.7	0.6	0.8	0.2	0.4	0.4	0.3
10+	2	0.8	1.6	0.6	1.1	0.2	0

estimated % age composition of the commercial trap net catch Spring Zone 2

	1993	1994	1995	1996	1997	1998	1999
2							
3	4.2	0.6	1.2	0.1			
4	64.7	52	59.7	25.4	25.5	22.9	21.1
5	27.3	39.2	32.1	58.5	29.9	38.1	47.3
6	3.5	6.6	5.6	13	32.6	18.1	21.5
7	1.2	1	1.2	2.5	8.8	16.9	8.5
8	0.2	0.4	0.1	0.4	3	3	1.3
9		0.1	0.1		0.1	1	0.2
10+					0.1		

estimated % age composition of the commercial trap net catch Spring Zone 3

	1993	1994	1995	1996	1997	1998	1999	2000
2								
3			1	0.6				
4			50	18.3	24.1	22	16.5	4.6
5			27.9	46.9	25.6	34.4	34.3	42.1
6			10.6	17	30.2	16.1	22.2	26.7
7			4.1	8.7	11.7	19.2	15.7	15.6
8			2	2.9	6.4	5.2	5.9	7.8
9			1.8	1.3	0.5	2.1	4.1	2.6
10+			2.4	4.3	1.5	1.1	1.3	

YEAR		WM __				
		DEAD FISH				
ID #	EFFORT	LK TRT	BRN TRT	KING	OTHER	OTHER
